Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Phase diagram of ferromagnetic spinor bosons in an optical lattice under an external magnetic field[1] KOHAKU H. Z. SO, Department of Physics, University of Tokyo, MASAHITO UEDA, Department of Physics, University of Tokyo, and RIKEN Center for Emergent Matter Science (CEMS) — Recently, cold atoms with spin degrees of freedom have attracted considerable interest because of the possibility they offer of modelling quantum magnetism and exploring the interplay between spatial and spin degrees of freedom. While spinor bosons with antiferromagnetic interaction loaded in optical lattices have been widely studied in this context because of their properties such as an even-odd effect in the superfluid to Mott-insulator transition, those with ferromagnetic interaction has not been studied extensively. However, mean-field analysis in the continuum systems suggests that the competition between an external magnetic field and the ferromagnetic interaction could give rise to new and rich phases. We have studied ferromagnetic spinor bosons in an optical lattice under an external magnetic field. Using the decoupling mean-field approximation, we have obtained a rich ground-state phase diagram, in which, in addition to the well-known Mott-insulator and superfluid phases, polar and broken-axisymmetry superfluid phases arise. We also found that the transition between broken-axisymmetry superfluid phase and other phases is a first-order one across some part of the phase boundary, in remarkable contrast to the case without external magnetic fields.

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Date submitted: 06 Nov 2015 Electronic form version 1.4